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MILK

THE INDISPENSABLE FOOD FOR CHILDREN

BY

DOROTHY REED MENDENHALL, M. D.

CARE OF CHILDREN SERIES No. 4
Bureau Publication No. 35

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MILK

THE INDISPENSABLE FOOD FOR CHILDREN.

INTRODUCTION.

Our Nation, with the majority of all civilized nations, finds itself plunged into a world war. As the atmosphere clears, after the first tremendous endeavor to create armies and to feed and equip our own soldiers as well as the population of our allies, thinking people are asking themselves how our home population is to maintain its health and the standards of living which have cost us so much effort to achieve. How will war affect the health and welfare of our children? What can we learn from the experience of European countries, already at war over three years, in regard to the influence on child life of the changes and privations inevitably produced by the war? What dangers and disasters may we avert if we take immediate precautions to prevent war conditions from affecting our child population in the adverse ways so plainly shown in Europe?①[1]②

The necessity of our Nation's feeding an ever-increasing number must be granted; also, that this food can be obtained in only two ways—by increased production or by decreased use of food in this country. The saving of food in this latter way may be brought about partly by persuading individuals to eat less and to choose certain types of food which can not be exported, and partly by eliminating waste. It is probably safe to assert that curtailing the total amount of his daily diet will be beneficial for the average adult. More than this, we are willing to agree that substitution of one type of food for another of the same type can be safely carried out by the average healthy American adult to-day if the substitution is intelligently planned.

On the other hand, the average child in America can not have its usual amount of food safely curtailed, nor is it wise during childhood to attempt, except in the case of cereals, to exchange or substitute the important articles of food. The results of underfeeding or indiscriminate food substitution in childhood are startlingly shown abroad as a result of the war, and are beginning to be evident in our own great cities.

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[1] The circled figures used throughout refer to corresponding figures in the list of references found on pp. 30 to 31.

Above all, the public must understand that milk is an essential food, not only for infants but for children of all ages, for pregnant and nursing mothers, and for the sick and wounded.③ Milk has no substitute in the diet of the child.④⑤ "The regular use of milk is the greatest single factor of safety in the human diet." Hitherto our national health has depended largely on our use of dairy products, for milk and its products have formed at least one-fifth of our national food. To obtain this proportion of dairy products for the American diet we have in the past had to import large quantities, especially of cheese. Now such imports have entirely ceased.

Of European countries, Great Britain, Germany, Austria-Hungary, and Belgium were formerly large importers of butter and cheese. Such commodities were obtained largely from Scandinavia, Denmark, and Russia;⑥ but England and Belgium can no longer get this necessary food from Europe. Therefore the United States, which hitherto has not produced enough for her own consumption and has only exported relatively small quantities of dairy products, is called upon to supply these countries as well as France, Italy, and our other allies. Our export trade in 1917 in butter is estimated to have increased 8 times, in condensed milk 16 times, and in cheese 26 times over that of 1913,[1] and our total export trade in these three articles reaches now the equivalent of nearly 2,000,000,000 pounds of milk (over 908,000,000 quarts) annually.⑦

EFFECT OF WAR ON THE PRODUCTION AND CONSUMPTION OF MILK.

In Europe the milch cow has been sacrificed because of the necessity for meat or the inability to obtain fodder, since large areas of cultivated, fertile land have been laid waste or abandoned and farm labor has been drafted into the army. The United States must supply our allies' lack in dairy products. The number of milch cows in the United States must be increased or the entire world will face the calamity of a shortage in milk, the essential food for the child. We do not realize, as Mr. Hoover points out, "the critical importance of maintenance of our domestic animals in a period of food shortage. We can not even raise our own young without them."⑤

The need of the conservation and increase of dairy herds is shown in the fact that the increase of population in this country has not

---

[1] Exports of butter, cheese, and milk from the United States:

	Butter.	Cheese.	Condensed milk.
	Pounds.	*Pounds.*	*Pounds.*
1913	3,585,600	2,599,058	16,525,918
1917	26,835,092	66,087,213	259,102,213

been accompanied by a relative increase in the number of milch cows. To-day the United States produces only about a quart[1] of milk per capita per day. Moreover, the per capita milk production has not increased since 1900 and will undoubtedly fall rapidly unless immediate steps are taken to conserve and augment the number of dairy cows in the United States. There seems to be a difference of opinion as to whether our dairy cows have already begun to be sacrificed owing to changes in the price of fodder and the fluctuations in the demand for dairy products caused by increases in the price of milk. That such a decrease in the number of cows will ultimately result unless radical steps are taken to save the dairy industry seems certain. As feed has increased recently 100 to 200 per cent in price in this country, while the price of milk has advanced only 20 per cent, how can the production of milk be a paying business proposition to the farmer who has to buy feed? As the United States Department of Agriculture and the United States Food Administration point out, it is a most short-sighted policy to permit the decline of the number of milch cows in the country, for it is obvious that "it will be easier to recover wheat acreage than the lost herds." We should, moreover, as a war measure, take immediate steps to increase the dairy cattle in the United States and to develop herds in those sections of our country now without dairy interests, in order that milk products may be available to all our people.

Butter, cheese, and condensed milk, because of their ease of transportation and their high nutritive value relative to their bulk, are the forms of milk that must be shipped abroad. The form that should be used in this country, as will be brought out later, is whole milk for the use of children and skim milk for household cooking and commercial purposes. Roughly speaking, two-fifths or more of all milk produced in this country goes into butter production and two-fifths is used as milk. We may, then, estimate that per capita, if we produce only a quart of milk, we use to-day less than 0.8 pint of this quart as milk, and that this proportion is steadily falling.

It is indeed possible that in the near future the United States may have to take the same steps that have been taken in England and in Italy, regulating the sale of cream or even curtailing the use of butter, in order that our child population may receive the more adequate and economical nourishment offered by whole milk. We may also profitably study the way the Germans have controlled the milk situation. Germany protected the nutrition of her childern under 6 years of age by fixing the price of milk early in the war, and by insuring the use of milk for nursing mothers, weaned infants, young children, and the sick. The adult civilian population in Germany has been practically deprived of milk, as the army's need is filled next, and the total milk supply has fallen to 60 per cent of the production previous to the war.⑩ ⑤

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[1] U. S. Department of Agriculture gives:⊙ 105 gallons per capita annual production of milk in the United States; 1.15 quarts per capita daily production in the United States. Assuming 40 per cent of milk produced is used as milk, 0.9 pint will be the average daily consumption of milk in the United States.

U. S. Food Administration gives:⊙ 70 gallons per capita annual production of milk in the United States; 0.82 quart per capita daily production of milk in the United States. Assuming 40 per cent of milk produced is used as milk, 0.65 pint will be average daily consumption of milk.

Even before our Nation entered the war there had been a wide increase in the prices of our most important foods, as well as an actual deficiency in certain foodstuffs. There seems also good evidence that the nutrition of our children had begun to suffer a corresponding deterioration.

In the autumn of 1917 the price of milk was advanced throughout the country about 2 cents a quart to the consumer, and must advance again unless the cost of distribution can be controlled or diminished. As a direct result of the advance in the price of milk, in our large cities less milk has been taken by the average family, especially by the family with a small income. Because less milk was bought, less milk was brought into the cities, and, as a result, demoralization of the dairy industry is threatened. Farmers will not produce market milk at a price below cost or if there is any doubt of their being able to dispose of their product.

In New York City, according to the report of the mayor's milk committee, the total supply of milk for the city is stated to have been reduced 25 per cent and the consumption of milk in certain sections of the city—the tenement region—to have decreased 50 per cent. Both of these changes were attributed to the increased price of milk this autumn.

A survey was made including all the boroughs of New York City during the second week of October, 1917, under the joint auspices of the department of health, the New York Association for Improving the Condition of the Poor, and the mayor's committee on milk.⑪ Information was obtained from 2,200 families each containing two children under 6 years of age. The striking feature of this report is the proof that in certain sections of the city the quantity of milk used by infants and children had been reduced, due to the increased cost of milk, below the minimum necessary for the maintenance of health.

The information collected in this survey was as follows:

> The 2,200 families visited represented 12,439 individuals, of which 4,467 were adults, 2,534 were children from 6 to 13 years old, 5,438 were children under 6 years.
>
> The total amount of milk purchased by these families at the present time is 3,193 quarts daily; a year ago it was 4,797 quarts daily. This represents a decrease of 1,604 quarts. This decrease, to be sure, is slightly offset by an increased consumption of condensed milk, according to the survey, of 141 tins daily.
>
> It is well to compare these figures with the following estimated amounts which physiologists and pediatrists regard as the normal milk requirement * * * 8,194 quarts: 121 families were getting more milk than they did a year ago, 599 families

were getting the same amount, 1,480 families were getting less milk, and of these 120 families were getting no milk; 420 families were getting more condensed milk.

Of the 120 families which had dropped milk altogether, 73 substituted canned condensed milk, 969 of the 1,480 were getting from 25 to 50 per cent less milk, and 1,213 of the 1,480 families were substituting tea and coffee for milk.

In the 2,200 families visited, 982 had babies less than 1 year of age. Of these 562 received less milk than in 1916, 316 received the same amount, 79 received more milk than in 1916, and 25 had dropped milk entirely.

Of 807 families 266 had changed from grade A to grade B milk, 67 had changed from grade B to grade C milk, and 474 had changed from bottled to dipped milk; 2,148 children under 6 years of age were drinking tea and coffee.

A similar state of affairs is threatening to develop throughout the country, and it is time for the Nation to realize what will result from a decreased use of milk by our children. It is the duty now of every individual community to see that its children have milk of good quality and in sufficient amount to assure their normal development. To do this the price of milk must be controlled or fixed, and the milk supply to infants and children carefully safeguarded. The malnutrition of our children was, even before 1914, a serious national problem and one demanding urgent attention. Poverty and ignorance of dietary essentials have been ever-present factors in the malnutrition of the young, and war conditions can not fail to increase the gravity of the situation and the difficulties of maintaining the health of the Nation.

THE NATURE OF MILK AS A FOOD.

Milk is often stated to be a perfect food. By this we mean that it contains all the essential elements for normal human growth and development.

The adequacy of a food or diet depends briefly on its containing:⑫

1. Enough of the right sort of material to build up and repair the living tissues of the body. These body-building substances in the food are called proteins, and are found especially in milk, meat, fish, eggs, and in certain vegetables, especially beans and peas.

2. Enough substances to furnish the required energy of the body. Fats, starches, and sugars are the chief energy foods, and are transformed in the body into energy for work and into body heat.

3. A variety of mineral substances, which are needed in the growth and functioning of the parts of the body, such as the skeleton, the brain, the blood, etc.

4. An adequate amount of certain substances whose nature is not yet fully known but whose presence in the diet has been demonstrated to affect body growth in animals or man. These substances, known as vitamines, growth determinants, or the unknown dietary factors, are therefore essential elements in our food.

5. No substance poisonous to the average individual nor one which will not allow of normal digestive processes.

In addition, to be properly digested and of the utmost nutritive value, articles of diet must also be of pleasing taste, palatable, and preferably of a consistency and appearance similar to the foods in customary use by the race.

Clean milk fulfills all of these requirements for an adequate food better than any other single foodstuff.

Milk is, then, in a sense, a complete food; if used as the sole food it will sustain life and allow growth. It is used as an exclusive diet for young children, but after infancy supplementary foods need to be included in the diet for the best development. For one reason, milk—which, in respect to all its ingredients, ranks among the most digestible of animal foods—is so completely digested that there is practically no waste. Though this complete digestibility renders milk one of the most efficient foodstuffs, a certain amount of non-digestible material in the food—so-called roughage—is necessary to regulate the discharges from the digestive tract. For this reason, and for several others, a mixed diet after the first year of life is better than an exclusive milk diet.

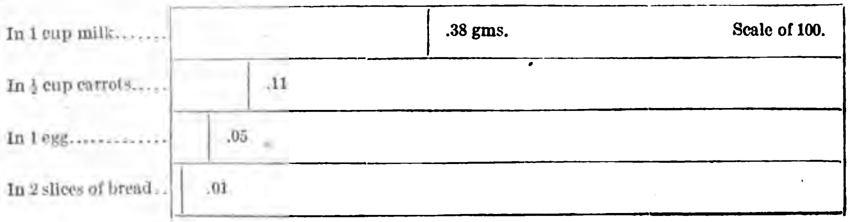
Milk has in the curd a protein of a more valuable nature in regard to its ability for building or renewing body tissues than that found in vegetables or even in meat. There is no other animal protein procurable at so low a price. ⑬ ⑭

Milk as a source of energy, or as fuel for the body, compares most favorably with other foods. The energy value of a quart of milk is about equivalent to that of a pound of lean meat or to eight eggs. As a source of energy cereals are, however, far cheaper than either milk, meat, or eggs; and, therefore, cereal and milk is the ideal combination of foods to furnish body energy in childhood.

Calcium salts (lime), supplied in our food, are necessary not only for bone formation but for the development of the important organs of the body, especially the glands of internal secretion.

Of all foodstuffs milk is the cheapest and most abundant source of calcium and milk also provides other important mineral salts, such as potassium and phosphorus. Therefore, since growth is measured by bone formation, and since the child must have a steady abundant supply of these essential minerals, milk should be included in every child's diet.

Relative amount of calcium oxide. (*Blunt.*) ⑮



Unfortunately cows' milk is low in iron content, even as compared with human milk, and this important mineral must be supplied in other foods. The prolonged exclusive use of milk after early infancy tends to produce an anemia from lack of iron in the blood. Iron can best be introduced into the diet through the early use of fruit, vegetables, and whole cereals.

The abundance, character, and digestibility of its proteins and its large mineral content make milk, as we have shown, a most desirable food; but, after all, the most valuable properties of milk lie in its containing an abundance of the unknown dietary factors—the vitamines which control growth and health. One such substance is found chiefly in milk fat and the organic fat of certain other animals, but is not present in vegetable oils or in pork fat. Eggs and green vegetables, such as spinach and chard, do contain appreciable amounts of this vitamine, but milk is our chief source. The cream of a quart of milk contains as much of this vital substance as is found in all the skim milk left after the cream is removed. A second recognized vitamine is present in all foods consumed in their natural state and in sufficient abundance to maintain health. In the manufacturing of purified foodstuffs, such as the polishing of rice or in the milling of flour, ⑯ ⑰ this substance may be lost, and a diet made up entirely of denatured foods may cause disease or even death, due to a deficiency in this essential substance.

A food like milk which, given in moderate amounts, combines enough of *both* of these vitamines to allow of normal growth and development, has a value in the human dietary greater than that of any other single food.

It is true that appetite in many cases has to be considered, and an exclusive diet of any single food substance becomes distasteful to the large majority of us and tends to lower digestive processes and to cause impaired nutrition. However, this does not mean that the child should be allowed to refuse milk as a substantial part of his daily diet, if the diet includes, as it should, several other forms of food. All normal children are better for at least 1½ pints of milk a a day. Poverty, of course, may prevent this amount being provided for every child, but, if her means permit, the mother who does not furnish sufficient milk for her children and train them to drink it is not fulfilling her duty. Healthy children can be made to like a varied diet, to eat what is good for them, and to finish the entire meal provided. Patience, persistence, and tact are needed to teach proper food habits to the young, and, to be effective, this discipline must be maintained from birth.

Milk may be given to the child in cooked form, as soup, weak cocoa, or flavored milk shake.⑱ If used as a drink, it should be taken toward the last of the meal, for many children will not take sufficient other food if they fill themselves up first with milk.

Children who have too rich or too abundant a diet may seem to do better with less or even without any milk, but here the fault is not primarily the quantity of milk but the total amount of food. On the other hand, an exclusive milk diet after the first year is ultimately harmful, and milk should not be included in the diet of the child to such an extent as to prevent the taking of an ordinary amount and variety of food. Many children can take and thrive on a quart or more of milk a day. Very rarely a child has an idiosyncrasy for milk protein and is made violently ill by milk.

WHAT KINDS OF MILK CAN BE USED FOR INFANTS.

Among the lower animals the young are not as a rule born until near the period when they can dispense with maternal nourishment and forage for themselves. It is important to keep in mind the fact that the human infant was evidently intended to be dependent on the mother's nourishment for at least the first year of life, as the infant does not develop teeth nor acquire the power of taking other than liquid food for many months after birth.

Any infant that has to be artificially fed during the first months of life is then in a sense a premature child, as it has been deprived of maternal feeding long before the normal period of separation from its mother. The giving of any other food than human milk to a young infant is, therefore, introducing a foreign substance into its partially developed digestive system, the dangers of which vary with the individual as well as with the composition of the artificial food selected and are still little appreciated.

BREAST MILK: THE BEST FOOD FOR BABIES.

For these reasons breast milk—the natural food for the human young—is the best food under any circumstances for the young infant. There is nothing "just as good" as mother's milk. The fact that the milk of a particular woman may not agree with her child or that it may be inadequate does not alter the truth of the general proposition: *Breast milk is best for babies.* Never before in the history of civilization has it been so urgent a matter that every child should have breast milk for as long a time as possible, in order that every child that survives birth may have the best chance for life and health. Never before have so many nations had to count on replacing the man-power lost in war by the infants born to these nations. To-day the survival of great races depends on the conservation of child life.

Also, never before has there been greater stringency of foodstuffs in the entire world, or greater urgency for economy in every American home. Whatever the present percentage of artificial feeding among our young infants, and it is sometimes estimated that one-fifth of all infants under 1 year of age are weaned before the fourth month of life,[1] two things may be positively stated. The first is that taking the infants who survive the accidents and perils of birth, undoubtedly those infants who are artificially fed die during the first year of life in a far greater proportion than those breast fed for at least the first six months; and the second point is that, judging by the work done in our large cities in the past few years, the number of children breast fed and the length of period of breast feeding can be greatly increased by careful supervision of the mother before and after the birth of the child.

Breast feeding during war time is a high patriotic duty as it is a sure method of reducing infant mortality and of conserving the national food supply. Breast feeding is better for the child, better for the mother, and incidentally better for the family pocketbook.

If other nations have already made a patriotic appeal to mothers to share their breast milk with children other than their own, surely the American mother will help win the war by nursing her own child for as long a period as it can thrive on her milk and by lengthening this period by every effort in her power.

ARTIFICIAL FEEDING OF YOUNG CHILDREN.

The only foods that we have that were intended as the exclusive food of young animals are milk and eggs. If we except the germ of seed all other substances suitable for their nourishment are taken from partially or fully grown animal or vegetable structures. For this reason we should expect milk, eggs, and the germ of seed to contain the vital elements for the maintenance of young life, and all experiments go to prove that they do.

Unfortunately, egg and seed do not lend themselves to the early or exclusive feeding of the human infant. To be sure, infants in Japan are occasionally fed even from birth on a soy-bean mixture, but considering the difficulties and dangers of such substitution, and judging by the high infant death rate in Japan, it seems superfluous to argue for any other principal form of artificial food for the infant than some form of milk, when this can be obtained.

COWS' MILK: THE BEST SUBSTITUTE FOR BREAST MILK.

Although cows' milk, as compared with milk from other domesticated animals, such as the goat, is not in some respects nearest in composition to human milk, the development of the dairy cow has brought about its almost exclusive use in this country as a substitute food for infants.

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[1] In the nine cities in which infant mortality studies have been made by the Children's Bureau, it was found that of the 21,962 infants who lived to be 3 months of age, 4,457 or 20.3 per cent had been weaned.

The fact can not be challenged that for children under 2, other than those breast fed, cows' milk is an absolute necessity if disease and death are to be kept within bounds and if the coming generation is to survive and is to sustain the national standards. Milk for the use of our allies and our soldiers in the field must be supplied, but it is equally necessary that the young children of the United States should be furnished with a supply of cows' milk, sufficient to form their chief source of food and adequate to produce in them normal growth and development. Production must be increased, and the price of milk and use of dairy products by the adult home population controlled, if necessary, to assure our children this indispensable food. "Children first" must be part of the national food slogan.

Cows' milk having been accepted as necessary during the early years of life the question next to be settled is what form of cows' milk—raw, pasteurized, sterilized, partly evaporated, or dried—is the safest, and the best adapted to the nourishment of our children, and which type of milk is best suited to transportation and available in all localities.

In general, we must grant that cows' milk to be a safe food for anyone must be clean and free from the germs of disease. In regard to an infant's food these points are even more important than in the question of food for older children or adults.

Cows' milk should not only be pure but the fresher it is and the fewer manipulations it has been subjected to, the less possibility there is of its having been altered in any of its essential properties as a complete food. Our knowledge of the fundamental nutritive qualities of milk is still incomplete, so that we can not absolutely affirm that heat, chemicals, or mechanical manipulation do not in some essential way alter its nature as a food.

For these reasons fresh, clean, raw cows' milk is the ideal form of artificial food and therefore the most desirable for the human infant. The modification of cows' milk to adapt it to the needs and digestive ability of the average child is covered in another bulletin of the Children's Bureau, Infant Care, and will not be discussed here.

PASTEURIZED MILK.

Even though pure cows' milk is the milk of choice for infants, it is not always possible to obtain raw milk in a state suitable to be fed to a young infant. Milk fit to be used raw must be produced under conditions which insure rigid, scientific inspection of the dairy, the cow, and the care given to the milk, and which also allow of the milk being used in a relatively short time after it is produced. In our large cities—where milk has to be furnished to thousands of infants, where it has to be supplied from a large number of small and large dairies so that adequate inspection is difficult, and where it must be transported long distances and kept for a long time—ordinary raw milk is not a safe food for infants.[1] Safe raw milk can be obtained in our large cities, but only at a price prohibitive except to families with incomes far above the average.

The question of pasteurization must, therefore, be briefly considered.⑲ In *pasteurizing milk* it is generally heated to 145° F. and held at this temperature 30 minutes. This process when done by the best commercial methods, destroys 99 per cent of the bacteria (germs) present in milk and considerably delays its souring. However, the important result of pasteurization is that, *if properly done*, it effectually kills any disease germs likely to be present, such as the germs of tuberculosis, diphtheria, or typhoid fever. For this reason, to render milk a safe food for the infant population, pasteurization is carried out to some extent in the majority of our cities of 10,000 inhabitants or over and 50 per cent or more of the milk that is used in seven of our largest cities is pasteurized.

Pasteurized milk is not sterile, and it will not keep unless quickly chilled and kept chilled until used; and it should be used within 36 hours after being pasteurized. Stale pasteurized milk may be more dangerous than stale raw milk, because putrefaction, if started, will progress more rapidly in milk which has been pasteurized.

STERILIZED MILK.

The further question of *sterilization* of milk raises another point. Milk boiled, or heated to 212° F., is often spoken of as sterilized milk. Milk is not sterile, that is, free from all forms of living organisms, unless it is subjected to this high temperature for an hour or more, and on successive days. Boiling for five minutes does kill all ordinary bacteria and does render milk for all intents and purposes a sterile food. Boiling, however, changes the chemical and physical properties of milk quite appreciably, which is not true, at least to any marked degree, in the case of pasteurization. The curd of boiled milk is distinctly more digestible, though more constipating, than the curd of either raw or pasteurized milk, since the curd of milk which has been subjected to such a high temperature forms a fine, easily broken down clot in the stomach.⑳ This modification of the casein or curd of cows' milk to render it more like the curd of mother's milk and therefore more digestible can be brought about, however, in several ways other than by boiling.

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[1] The requirements of a pure milk vary greatly in different localities. In New York City a grade A milk (raw) must have come from a tuberculin-tested herd in good physical condition and from a dairy scoring at least 25 points on equipment and 50 points on methods; its bacterial content must not exceed 60,000 per cubic centimeter, and it must be delivered in labeled bottles 36 hours after production. A grade A milk (pasteurized) must have come from healthy cows examined annually and from dairies scoring at least 25 points on equipment and 43 on method; its bacterial content must not exceed 30,000 per cubic centimeter, and no milk supply averaging more than 200,000 bacteria per cubic centimeter shall be pasteurized to be sold under this designation; it must be delivered in labeled bottles within 36 hours of pasteurization. In so-called "certified" milk the requirements are even more stringent than for grade A milk. The greater part of the milk consumed in this country is below grade A requirements.

The possibility of the change or loss of some of the essential nutritive properties of milk by the effects of high temperatures has been much discussed and very generally disagreed upon, especially the effect of heat on the mineral matter and on the undetermined factors which induce growth—the vitamines.㉑ ㉒ ㉓ Boiled milk, however, has been used very extensively in Europe for the feeding of young infants and with apparently great success.

CANNED MILK.

To-day, in large areas of our country there are no milch cows. In other large areas, including some of our big cities, it is becoming increasingly difficult to obtain a good grade of bottled milk, raw or pasteurized, at a price thought possible by the average parent. The dangers and delays in transportation, the difficulties of distributing milk rapidly and in an iced condition, the expense of this rapid transportation, distribution, and refrigeration are such that the question of canned milk for infant feeding is forced on our attention. Milk in a condition allowing of safe transportation for long distances, is at the present crisis a necessity. The problems arising from war conditions, especially our duty to assist our allies in feeding their child population, the necessity of our maintaining an adequate food supply for our own soldiers in cantonment at home or abroad, and the possibility in the near future of having to supplement the food of our men in prison camps in Germany if their starvation is to be averted㉔—all these are additional circumstances which force us to consider the varieties and relative merits of different forms of canned milk.

As regards infant feeding, there are four kinds of canned milk now available:

Certain proprietary or patent foods.
Condensed milk (sweetened).
Evaporated milk (unsweetened condensed milk).
Dry milk or milk powder.

The relative merits of each of these will be briefly discussed.

CERTAIN PROPRIETARY OR PATENT FOODS.

Proprietary or patent foods, so called, are of two types. We may divide them into class A, those having milk—usually in the form of dry milk—as one of their ingredients, and class B, those having no milk in their composition.㉕

The latter class of proprietary foods consists largely of combinations of sugar and starch, which are of no greater efficiency in an infant's diet or for the nourishment of older children and invalids than certain flours, cereals, and sugar purchasable in bulk and at a much lower price in any grocery store. Patent foods of this type should be used only in combination with cows' milk, and they are not a complete food without this milk. As modifiers of milk, or additional foods to be used with milk, they are an unnecessarily expensive product.

Proprietary foods of class A embrace those forms of patent food containing milk in their combination. They may or may not be a sufficiently complete food for an infant, but they all have the disadvantage of being considerably more expensive than is necessary for an adequate infant food. The foodstuffs present in any proprietary food can be purchased more reasonably uncombined and these ingredients can be combined more judiciously for each infant separately than when given out under a trade name for the whole infant public. Infants have been reared successfully on patent foods, but many infants have been unnecessarily sacrificed to the hit-or-miss principle of prescribing one combination of foodstuffs to meet the need of all children.

CONDENSED MILK (SWEETENED).

What is commonly known as condensed milk is a sweetened milk. Evaporated milk is an unsweetened condensed milk. Commercially, condensed milk is usually made by adding to fresh milk large quantities of cane sugar, heating the milk to dissolve the sugar, and then evaporating the whole, until its bulk is two-fifths that of fresh milk or less, and its sugar content is about 40 per cent by weight. Sweetened condensed, sweetened evaporated, or sweetened concentrated whole milk under our food and drug regulations must be the product of evaporation of whole, fresh, clean cows' milk and must contain at least 8 per cent fat and not less than 28 per cent total milk solids.㉖ The product is heated to a considerable temperature for a short period to dissolve the sugar, but it is not sterilized in the canning.㉗ The high percentage of sugar, however, tends to preserve it. Since the heat used in the entire process is only from 180° to 200° F., and is applied for a brief time, the more resistant forms of germs may persist in such milk, though they do not grow or increase in a properly canned product.

Condensed milk is a semifluid substance of a very sweet flavor, and is put on the markets in varying sized and priced cans. The high sugar content of this milk practically prevents its freezing in transportation, so that it has been the chief form of canned milk shipped up to this time. If made properly it will keep well until opened, but it is best when fresh. Once opened this form of milk tends to spoil and should be taken from the tin, kept iced, and used within a very few days.

This product was the first form of canned milk put on the market. The early French inventions along this line, dating back over a hundred years, are said to have been called forth by Napoleon's efforts to obtain a milk that could be transported for the use of his armies. It is interesting to note here that canning milk first became a successful business enterprise because of the urgency in this country of feeding the soldiers of the North in the Civil War. Milk was demanded that would keep under transportation and still be of a bulk to make transportation possible. The condensed milk business received a tremendous impetus at this time.

During the present war, the demand for canned milk has again become insistent, and its production, especially for export trade, has been greatly stimulated. The use of canned milk will undoubtedly become widespread, both in this country and in the countries of Europe, and it is most essential that the best forms of these products shall be generally used, especially the canned milk which is best adapted for the nourishment of infants and young children, and for use as a food for convalescents.

Sweetened condensed milk has been used in the feeding of [illegible] for several generations and has been also of considerable use in the general [illegible] of the household. As an infant food it has [illegible] relatively high sugar content. With a [illegible] sweetened condensed milk must be [illegible] the average [illegible] the percentage of the other ingredients [illegible] the [illegible] the protein [illegible]

It is, however, certainly not the form of canned milk to choose for the adequate nourishment of children or adults where fresh milk can not be obtained and transportation of food products from too great distances must be considered. We should also recognize that condensed milk has the disadvantage of a high water content even after evaporation, and is unnecessarily bulky for shipping.

EVAPORATED MILK (UNSWEETENED CONDENSED MILK).

Commercially, this product is made by taking fresh milk, adding nothing to it, evaporating it down to one-half or two-fifths the original bulk, placing it in cans, and then sterilizing the contents by subjecting the cans to steam under pressure. The temperature must be "high enough and maintained long enough to insure absolute sterility to the product and to give the milk sufficient body to prevent the separation of the butter fat in subsequent transportation and storage."㉗

It is a difficult matter in the process of condensing or evaporating milk to have a product of a uniformly good quality and composition, or to be able to detect such faults. Any form of condensed milk will usually give unmistakable evidence if it has spoiled before opening, and hence there is little danger of putrid canned milk being used. There are, however, two real dangers in the use of any condensed milk. One lies in the fact that the quality of milk used in canning is frequently not the best; also in the case of sweetened condensed milk, an unsterile product, the possibility of disease germs surviving in poorly processed milks must be considered. The second danger is the fact that once opened condensed milk or evaporated milk is easily contaminated, deteriorates rapidly, and so becomes unfit for use as an infant food.

Evaporated milk has the consistency, taste, and appearance of thin cream. If properly made it is a sterile product and will keep unopened indefinitely, but it is stated to be "best when fresh."

The regulations governing evaporated milk under the pure food and drug laws are those governing all condensed whole milks, but it must contain not less than 25.5 per cent of total solids, and 7.8 per cent of milk fat.㉘ The relative proportion of the original ingredients of milk—the so-called "milk solids"—is about the same in the analyses given of sweetened condensed and evaporated (unsweetened condensed) milk. The sweetened condensed milk differs not only in the high content of cane sugar but has as a rule each of the milk solids in a slightly higher proportion probably due to a greater degree of condensation than is usual in evaporated milk.

Average composition (Hunziker).

		Condensed (sweetened).		Evaporated (unsweetened condensed).	
Water			26.5		73.0
Milk solids	fat	9.0	32.6	8.3	27.0
	protein	8.5		7.5	
	milk sugar	13.3		9.7	
	ash	1.8		1.5	
Cane sugar			40.9		....
			100.0		100.0

Evaporated milk, if used when the can is first opened, is a safe food, because it is free of all germ life. It resembles in this point boiled milk, and like it, is superior in point of sterility and also in digestibility to pasteurized or raw milk, since the digestibility of both the fat and casein is probably increased by the exposure of the milk to high temperature in processing.

The butter-fat, milk-sugar, and mineral content is not appreciably altered in quantity by condensation, but the minerals are rendered less soluble by the process of sterilization. In the process of condensation some of the protein or curd is lost from the mechanical adhesion of the curd to the heated surfaces. The effect of the change in solubility of the minerals present has not been found to cause any appreciable difference to the child. From the feeding experiments recently conducted on animals, it does not seem probable that either of the vitamines, so far determined, is injured by high temperature. By diluting with equal parts of sterile water, evaporated milk can be reconstituted approximately as ordinary milk.

Evaporated milk has been and can be of great use in the general nutrition of the household, and it certainly has a more tenable place in the feeding of infants and young children, when fresh milk can not be obtained, than condensed milk. We must recognize the facts that it will freeze, and is therefore not suitable for transportation in cold weather; that it must be carefully handled after opening if it is to remain a sterile food and one fit to give an infant; and that even though condensed to one-half to two-fifths of its original bulk, it is still bulky to transport. Also all condensed milk is relatively high in price as compared with a grade A raw milk. Condensed milk is now retailing at 25 cents and evaporated milk at 15 cents a pound, and since both these milks are reduced one-half or more in bulk, these prices are about the price of 1 quart of reconstituted milk. All these reasons make evaporated milk far from the ideal substitute for fresh milk.

DRY MILK OR MILK POWDER.

The dry-milk industry began as a means of saving the skim milk, the by-product in the manufacture of butter and cream. On many farms to-day great quantities of skim milk are still wasted or uneconomically used in the feeding of animals. The movement to utilize this product in making more skim-milk powder or in the making of skim-milk cheese is an enterprise that should meet with the cooperation and assistance of all interested in the proper nourishment of our population.

Milk powder is now made in over 30 factories in this country ㉗ and by at least four essentially different processes.[1] Skim-milk powder was the first type produced in this country and is still the principal form on the market. It has a wide wholesale demand for use in bakeries and in the manufacture of ice cream and milk chocolate. The retail sale of any milk powder has never been great, and the use of skim-milk powder in family cooking has never received the attention which this valuable form of protein food deserves.

Milk is now also dried as whole milk, as milk with one-half the fat removed (half-skim milk), and as buttermilk, while the different constituents of the milk itself—the butter fat, casein, whey, or milk sugar—are separated by certain dry-milk concerns and put on the market as powders.

Under the food and drug regulations dried milk must be "the product resulting from the removal of water from milk, and contain not less than 26 per cent milk fat and not more than 5 per cent of moisture." ㉘

The essential point here as in every canned-milk product is that the original milk shall be of a high quality. No good canned milk can be produced from stale or impure milk.

After the question of the quality of milk used is settled, the important thing apparently in all processes now used in preparing milk powder is the degree of heat, and the period of heating of the milk in the process of drying. The processes differ very materially in these points, and it is difficult to tell exactly whether the properties of milk are more apt to be changed by being held at a low temperature (approximately 145° F. in process C) for hours, or at a high temperature (approximately 175° F. in process B or 275° F. in process A) for a very short time. Theoretically milk should suffer greater change the higher the temperature to which it is subjected, so that milk put out by processes in which a temperature not over 180° F. is used ought to be preferable. Such dry milk has the property of being completely soluble and of reconstituting in cold water, which is a tangible advantage.

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[1] The principal processes by which dried milk is made to-day are briefly as follows:

A. Milk is fed in a thin stream over two steam-heated cylinders or drums, about one-eighth of an inch apart and revolving in opposite directions. The milk exposed to the heat of the cylinders dries as a thin film and comes off the revolving cylinder as a sheet, which is easily crushed into a fine powder. The cylinders, which are some 60 inches long and 24 inches in diameter, are charged with steam under two or three atmospheres of pressure causing the heating surfaces to have a temperature of about 250° to 280° F. This process, known as the Just patent in the United States and as the Just-Hatmaker patent in England, is said to be the invention of J. R. Hatmaker, of London.

B. The milk is first pasteurized and then condensed in the vacuum pan at a low temperature (130° F.) to about one-fourth of its bulk. This condensed product is forced under high pressure through minute openings in a metal disk into a hot-air chamber. The atomized liquid surrounded by a current of hot air instantly dries and falls to the bottom of the chamber as a snowy powder, the moisture rising as a cloud of steam. The mixture of the liquid and air in the evaporating chamber is stated to be about 180° F. This method was originally developed in France and is called there and in England the Bevenot de Neveu process. In this country it is known as the Merrell-Gere process.

C. A third method of making dried milk, by reducing it to approximate dryness in a vacuum pan equipped with a mechanical stirrer, is also used in this country. It has the advantage of exposing the milk to a low though prolonged temperature.

In the early days of manufacturing milk powder, before the freshness of the milk was insisted on, some form of alkali was commonly added in the process of drying to neutralize the acidity of the milk, as well as to render the casein more soluble. Cane sugar or malt sugar was also frequently added.

By the perfection of the different steps used in the process, and especially by control of the temperature employed, milk powder to-day can be made of milk or any of its constituents without the addition of any foreign substance and yet be completely soluble in water. In the best preparations of dry whole or half-skim milk the constituents are also little, if any, altered from their natural state in fresh milk. The butter fat retains the globular form and readily emulsifies when mixed with water, the actual size of the fat globules are apparently reduced by the drying process, the albumen is not coagulated, and the casein is not toughened in drying and is still miscible in water. From recent animal experimentation it seems positive that the growth-promoting property of fresh milk is not appreciably diminished in milk powder made by the best methods. Whether or not dry whole milk is a complete food or whether, like sterilized and pasteurized milk, when fed alone to infants it may occasionally produce some degree of scurvy can not be definitely stated. In France and England, where it has been most used as an infant food, ㉚ no evidence is offered to show that scurvy follows its long or exclusive use.

Fermentation or bacterial decomposition of milk powder can not occur, as bacterial action does not take place in a substance with a moisture content under 5 per cent or 3 per cent as it is in the best milk powder.

All products containing milk fat keep better when placed in the cold and not exposed to light or air. One great drawback to the production of dry whole or half-skim milk has been the fact that the powder made by the old methods quickly became rancid. The manufacture of dry milk has been so improved that even dry whole milk is now put up in a form by the best processes that will keep unopened for at least a year and for many months even when opened without the detection of any rancid or "tallow" flavor, which is the first sign of deterioration. Nevertheless, the production of dry milk should be carefully regulated to meet the demand, and all canned milk should be dated to insure its use as food within a reasonable period.

Dry milk is put up in tin receptacles of different sizes, the price per pound varying with the manufacturer and the nature and character of the milk dried. Dry skim milk in bulk at wholesale sells as low as 24 cents a pound and dry whole milk at 42 cents a pound, which gives a whole milk, when it is properly reconstituted, at about 11 cents a quart. (January, 1918, prices.) The best brands of milk powder put out specially for infant use, however, retail at a price which is equivalent to milk from 12 to 20 cents a quart.

In infant feeding, milk powder has been of late years widely used by physicians in Belgium, France, and England, and with apparently great success, as far as can be judged by reported normal gains in weight and other evidences of good nutrition in children fed exclusively on this form of milk. Physicians in our large cities and in Germany have also recently been experimenting in the use of dry milk for infant feeding.

The good points about dry milk may be briefly stated as follows: (1) Increased digestibility, (2) bacterial purity, (3) keeping qualities—no ice needed, (4) convenience—always ready, (5) palatability, (6) cheapness—no waste, (7) transportation advantages—small bulk, does not freeze. Against dry milk it can be said that it is a canned product, a food subjected to high temperatures in the process of manufacture, and that there is no guaranty of the quality and cleanliness of the original milk.

Apparently, if we can judge by the experience abroad, dry milk from which half the cream approximately has been removed before drying, so-called "half-skim" dry milk, has distinct advantages in the feeding of very young infants. Possibly this is due to the fact that in the dilution of this milk a mixture relatively high in protein and sugar and relatively low in fat is obtained without the addition of extra sugar or casein, and such a mixture has a high enough nutritive value to produce normal growth. In older infants—those over 6 months of age—dry whole-milk mixtures are advocated and would seem theoretically advantageous, since at this age the child needs and can digest more fat, and the relatively low sugar of whole milk can be supplemented by cereals or by sugar, as is usually done with older infants fed cows' milk.

The following table of the relative composition of dried (1) whole milk, (2) half-skimmed milk and (3) skim milk is taken from Pritchard.

	Average percentage composition				Calorie value per ounce.
	Casein.	Albumen.	Sugar.	Fat.	
1. Whole milk	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2. Half-skimmed milk	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3. Skimmed milk	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The composition of whole dried milk has been specially studied by a number of authorities, and all agree that the milk solids are increased about eight times that of the original milk. Therefore to reconstitute an average milk with a fat between 3 and 4 per cent one part of milk powder should be taken to eight or eight and a half parts of water.

Composition of whole dry milk.[b]

Fat..................approximately..	25 to 28 per cent.
Protein..............................	Practically same as fat.
Sugar...............................	34 to 40 per cent.
Ash..................................	6 to 7 per cent.
Water...............................	5 to 7 per cent.

An interesting report on the analyses of specimens of dry milk from different countries has been made by Sommerville,[a] who gives as the mean analysis:

Fat..	28.5
Sugar...	36.8
Protein...	24.3
Salts..	5.6
Water...	4.8

The fact that the powder form of dry milk makes it possible to give it in as concentrated a form as desired—that is, with any quantity of water—makes dry milk a particularly useful form of food in cases of certain types of vomiting in infancy or wherever small amounts of fluid of high nutritive value are required.

The desirability of milk powder—the most concentrated form of milk—for use in traveling or for transportation to places where fresh milk is not available is self-evident. The French picturesquely characterize dry milk as "la vache en placard," "the cow in the cupboard." There are also certain occasions where for the sake of economy, even when fresh milk is available, dry milk seems to have a legitimate use to-day. Such a situation might occur when only one bottle feeding a day has to be given to an infant whose parents' means are limited.

For dispensary, hospital, or day-nursery use milk powder is distinctly more economical than any other form of cows' milk, for the cost of all equipment, including kitchen outfit, ice, refrigerating plant, and the large number of bottles is eliminated, as well as much of the service needed to prepare and dispense milk preparations. The use of dry milk, as directed by a physician, needs only the equipment and intelligence to boil water and measure in tablespoons.

The only other canned milk which stands any comparison with a good milk powder for infant use is evaporated milk. This product, however, has been sterilized at high temperatures for a long period, which may or may not affect the essential properties. Good dry milk can be made without pasteurization, though pasteurization is part of one of the best processes, and in the two processes most used the actual drying by the exposure of the milk to a high temperature, either around 175° F. where the milk has been previously pasteurized or around 275° F. where the milk has not been pasteurized, is practically instantaneous. Apparently this short high temperature exposure does not injure the essential nature of the vitamines as far as the present evidence goes.

Experience has taught the specialist concerned with the feeding of infants that a certain proportion of infants fed exclusively on boiled milk and water, or condensed milk and water, or on certain patent foods with or without the addition of sugar will develop more or less pronounced signs of scurvy. Recent investigation has made it seem probable that some infants whose sole food is pasteurized milk, sugar, and water, without the addition of fruit juice or vegetable water, will finally cease to grow, and may show also symptoms of scurvy of a more or less definite character.㉛ It is possible, therefore, that any milk, other than fresh raw milk, when used alone, may prove an inadequate or injurious food for infants and may not allow of normal growth either in weight or length. Such milk used exclusively will produce in a certain proportion of infants more or less distinct symptoms of scurvy, due either to the loss in heating of some undefined substance—probably not a vitamine㉜—or due to infection by bacteria or their products, the result of the milk's being stale when used.㉝ Therefore, whenever an infant is fed a canned or sterilized or even a pasteurized milk, fruit or vegetable juice should be begun early until we know exactly in what particulars these milks differ from fresh, clean, raw milk.

Up to this time, in the United States, little attention has been paid by the dry-milk manufacturers to putting out a product suitable for the use of infants and at the same time cheap enough to attract general notice. As yet very little milk of the best quality and produced under the most hygienic circumstances is dried. Much of the dry milk on the market is made from milk of an inferior quality and still contains bicarbonate of soda or some other alkali used to neutralize it, and the price of grade A dry milk on the market is considerably higher than the highest price asked for fresh grade A milk. Whole-milk powder or half-skim-milk powder made of grade A milk to which no addition of any foreign substance has been made should be available on the retail market to-day at a price equal to the cost of production plus a reasonable percentage of profit to the manufacturer and retailer. At the present prices of milk wholesale a grade A milk powder could probably be put out, if the retailing could be controlled, at a price allowing it to be reconstituted at 12 cents a quart.

There is a distinct need for the production of milk powder to-day. By this means more milk suitable for the use of young infants can be put on the market, and the children in Europe and in the distant parts of the United States can be adequately nourished, since good milk can be transported around the globe.

Dry skim milk, dry casein, and dry whey are forms of dry milk especially adapted for the use of the sick child, and are foods already well known to the medical profession under special trade names, which of course mean a high-priced product. The separate constituents of milk bring a lower price than dry whole milk, and they could be available for hospital use, or, in the case of skim milk, for use in household cooking if their properties and legitimate retail prices were known.

WHAT KINDS OF MILK CAN BE USED FOR THE OLDER CHILD AND FOR COOKING.

When it comes to the question of the nourishment of the child over 2 years of age, we can state two things absolutely: First, milk is an indispensable food for the growing child, essential for its proper growth and development, and, second, clean fresh milk is the best form of milk for the use of children of all ages. The reasons for these statements have already been discussed in the previous section and need not be reenumerated.

If good raw milk or pasteurized milk can not be obtained, moderately fresh canned milk—either evaporated or dried—may be used instead of fresh milk, under certain conditions.

Every growing child is better and more cheaply nourished if it is given clean whole milk, either as a drink or in the cooked food making up the daily diet. A pint and a half of whole milk daily is the safe amount thought desirable to nourish the young child (from 18 months to 12 years of age) when the rest of the diet is balanced.

If canned milk is used instead of fresh milk, the quality of the milk used in canning should be good, and the amount of milk given must be the equivalent of at least a pint and a half of whole fresh milk. There is a great danger that mothers unaccustomed to the use of canned milk may not properly apportion the amount of milk to be given to the child and for this reason allow either too little or more than is necessary or judicious for daily use. If skimmed milk is used instead of whole-milk powder, milk fat, which contains one of the essential factors necessary to produce normal growth in children, should be added to the diet in the form of butter or cream.

We should learn to distinguish between the property of butter due to the vitamine content and its property, common to all fats, of furnishing energy when consumed in the body. As far as its use as body fuel is concerned, butter is the equivalent of any edible animal or vegetable oil. Considering it in relation to its vitamine content no other fat is probably the equivalent of milk fat.㉞㉟ Pork fat and vegetable oils have, as far as is now known, little or no growth-producing power.⑰ Beef fat, however, does contain this essential vitamine, and margarine made from beef fat, especially margarine in the manufacture of which skim milk is used, has apparently about the same growth-producing power as butter.㊱ If we include sufficient whole milk (1½ pints) in the child's daily food, beef-fat margarine may be safely given instead of butter and for reasons of economy this may be a wise procedure. Lard, vegetable oil, and nut margarines are not substitutes for butter or for beef-fat margarine, as they are only fuel fats and not fats plus substances which determine body growth.㊱ Milk, butter, eggs, and beef drippings have been and are the chief source of the important vitamine found especially in animal fats. All of these foodstuffs are now exceedingly high in price and there is great danger that in the families of the poor where formerly beef drippings and even suet pudding㊲ have been the chief source of animal fat, vegetable oil or nut margarines—which are not equivalent either to beef fat or to butter—may be substituted as the only table fat in the diet of the growing child.

The experience abroad, in the case of wounded men during the present war, has pointed out another important attribute of milk. The presence of milk fat in the diet apparently promotes not only body growth but body repair, as seen in the healing of wounds, according to many references in the war literature. The urgency of a supply of milk and butter for hospital use and for our men in prison camps is then also apparent.

Skim milk has a legitimate use for the nutrition of children, if we look upon this substance simply as a form of protein, that is, a food similar to lean meat. It does not in any way take the place of whole milk for the child, because it lacks the essential fat. No more valuable or cheaper form of protein—body-building food—exists than skim milk and, to a large extent, skim milk can be substituted for meat in the child's dietary. Pound for pound, skim-milk cheese (cottage cheese) is about equivalent to beef.

In household cooking also skim milk can be made to take the place of whole milk and can be safely substituted for whole milk in preparing certain dishes, if, as has already been said, the amount of animal fat—other than lard—used in the dietary is carefully watched and not allowed to decrease markedly.

Ordinary cheese is a whole-milk product containing both fat and protein and is of great value in the dietary of adults and older children. Little children can not be given much whole-milk cheese, as it is somewhat difficult to digest. Skim-milk cheese contains, of course, no fat. It has the same food value as skim milk and is not indigestible.

SUMMARY.

Milk is, then, the indispensable food for children, and whole milk in some form must be furnished them, if the nutrition of the average child is to be maintained and if normal growth in height and weight is to be assured.

Previous to the present war the United States did not produce all the dairy products used in this country, and now, with the cessation of practically all importation of these foodstuffs, we are called upon to export large quantities of milk, butter, and cheese to feed our allies and our soldiers in Europe.

The sharp rise in the price of milk, a rise due to the increased cost of production, has resulted, in our large cities, in a diminished use of milk, and has greatly disturbed the regular supply of milk for city trade. One way in which the price of milk can be controlled is by reducing the cost of distribution or at least preventing its increase. Fluctuations in the demand for milk, or diminished use of milk throughout the country, will inevitably result in a lessened production and a decrease of the dairy business.

The destruction of the milch cow, the loss of our herds at this critical period, would be a calamity of far-reaching consequences and one from which the Nation would slowly recover. The herds of the Nation should be carefully augmented and the milk production per capita actually increased, since in peace times the United States produced no more and even less milk than that required for the maintenance of the health of its people. The exporting of milk must decrease the available supply for home consumption, even if the production per capita is not allowed to diminish.

The nourishment of our children is the first duty of the Nation. Every child from 18 months to 12 years of age is better for having [illegible] pints of milk in his daily diet. Since milk and milk products are a vital necessity for children, for nursing mothers, and for the sick and wounded, the public should be made to realize that the children's need for dairy products should be assured. If necessary, the use of milk, cream, or butter for adult consumption must be restricted.

The curtailing of food by the adult population is not a serious matter and may even be beneficial. The average child to-day does not have enough of the right sort of food and can not have its food cut down nor the important articles of its diet replaced by questionable substitutes without grave danger of increasing malnutrition in our child population.

Clean, fresh cows' milk is the best available form of milk for children after they are weaned. Pasteurized milk, sterilized milk, or canned milk may be substituted for it when clean fresh cows' milk can not be obtained.

The transportation of food to Europe and to distant parts of our own country, where the dairy business has not been developed, makes the production of a good quality of pure canned milk necessary. Evaporated milk (unsweetened condensed) and dry milk are the best available forms of canned milk for the use of children. Dry milk (milk powder), if its quality can be assured, appears to be the most desirable form of milk for distant transportation, for the use of young children, or for general household use where fresh or pasteurized milk is not obtainable. Every effort must be made to furnish some form of clean whole milk for the use of our child population, in order that war conditions may not have the adverse effect on them so plainly visible in the countries of Europe.

Lowered nutrition in children means decreased vitality and lowered resistance to disease. If the nutrition of our children is impaired for any length of time, full juvenile development will be permanently arrested. Nor is the physical stunting of the race the only evil that serious undernourishment of our child population entails. Intellectual and moral abnormality are largely influenced by physical health, and a period of malnutrition among the children of America may easily be followed by a period of intellectual and moral deterioration.

Victory in arms will be settled in this war by the stamina of our fighting men. Ultimate victory can come only to the Nation that carefully conserves the stamina of its children, upon whom depends the future of the race.

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